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A Local Network and a Method for Reproducing Audio and Video Data in Such a Network

BACKGROUND OF THE INVENTION

The present invention relates to the field of networks for multimedia systems, and in particular to the field of ring networks for automotive multimedia systems that transmit compressed data from data sources on the network to data sinks on the network for decoding/decompression.

Device combinations are known which consist of two devices: (i) a data source that provides compressed audio and video data (e.g., a DVD player), and (ii) a data sink (e.g., a TV) that reproduces the received audio and video data. The DVD player and the TV are connected to one another through a data line. With this combination, the compressed audio and video data stored on the DVD which are coded, among other standards, by the MPEG-2 standard, are read out, and decoded by an appropriate MPEG-2 decoder in the DVD player, and are thus decompressed. The decompressed data are then transmitted through the data line to the TV. The TV reproduces these decompressed data on its picture tube, for example as an FBAS signal corresponding to the video data received through the TV tuner. In a corresponding manner, the decompressed audio data in the TV receiver are conducted to an amplifier and then to loudspeakers connected thereto, so as to be reproduced. In this system, the data rate transmitted through the data line is very high. This imposes especially stringent requirements on the data line and on the bus which specifies the transmission format of the transmitted, decompressed data. Only a few audio and video signals can be transmitted through this data line simultaneously.

For example, European patent EP 519 111 B1 discloses local networks with several

subscribers, which are connected to one another to form a ring network by an optical data line. The optical data line transmits audio and/or video signals as well as control data. This local network has several subscribers, some of which (data sources) generate audio or video data and control data, and feed these into the ring network. Other subscribers of the network (data sinks) accept the data intended for them, processes the data, and cause them to be reproduced. Data sources can be such as input data into the data line of the network as uncompressed data or as compressed data. Accordingly, the data sinks which receive compressed data have a bit stream decoder, which decodes or decompresses the compressed data, and then these decompressed data are processed for reproduction. The DVD player and TV set described above can be subscribers of this local network. In this case, this device combination will have the disadvantages described previously.

Therefore, there is a need for system that does not require each data sink to include a decoder.

SUMMARY OF THE INVENTION

Briefly, according to an aspect of the invention, a method for reproducing audio and video data in a local network includes transmitting compressed audio and video data from a data source through an optical data line to a data sink, and decompressing the received compressed audio and video data to provide decompressed data. The decompressed data is processed at the data sink to provide decompressed audio data and decompressed video data. The decompressed audio data and the decompressed video data are transmitted from the data sink onto the ring network.

According to another aspect of the invention, a method for decompressing audio and video data in a local ring network includes, at a first data sink, (i) receiving compressed data transmitted

along a transmission medium of a local ring network at a first data sink, (ii) processing the compressed data to provide a decompressed audio signal, and (ii) transmitting the decompressed audio signal onto the local ring network. At a second data sink, (i) receiving the compressed data transmitted along the transmission medium of the local ring network, (ii) processing the compressed data to provide a decompressed video signal, and (ii) transmitting the decompressed audio signal onto the local ring network.--

The inventive local network, which is ideally suited for implementation in an automobile, transmits audio and video data jointly in compressed form from the data source, through the data line, to a data sink. In this data sink, the compressed audio and video data can first be conducted to a bit stream decoder to be jointly decoded (decompressed), and then conducted to a separation stage for separating the decompressed audio data from the decompressed video data, and then at least one data type is conducted, via the optical data line, to another subscriber of the network in order to be reproduced there.

Alternatively, the jointly transmitted compressed audio and video data are first conducted to a separation stage to separate the compressed audio data from the compressed video data, and these separated data types are subsequently each conducted to a bit stream decoder and then to an output unit. At least one type of decompressed data is conducted, through the optical data line, to the output unit. The separation stage can here form a single unit with the bit stream decoder. If the local network is structured in this manner, the various data sources can make do without the decoders which they have previously contained, for example the bit stream decoder in a DVD player. In a DVD player, the bit stream decoder for video data may be an MPEG-2 decoder, and for the audio data it is an MPEG-2 or a Dolby digital decoder. If, for example, several such data sources are to be disposed in a network, the invention now makes it possible to make do without

this plurality of bit stream decoders in the individual data sources for the joint transmission of audio and video data. This reduces the costs of the network together with its subscribers.

Only at the relevant data sink or sinks for compressed data is there a single bit stream decoder for decompressing the corresponding video data and audio data, which regularly results in a reduction of the decoder components in the data sinks.

The joint transmission of compressed audio and video data from the data source to the data sink or sinks utilizes the data transmission capacity of the network more efficiently. If the jointly transmitted audio and video data are first completely decoded by a bit stream decoder before they are separated by the separation stage, standardized devices for reproducing audio data or video data can be used as output units or as further data sinks. Typical devices for reproducing audio data are audio amplifiers with loudspeakers connected to them, and typical devices for reproducing video data are screens or projectors. In such a structure of the local network, the decompressed audio data and video data can also be reproduced by a network subscriber which is intended to reproduce other audio or video data from other data sources. This synergistic utilization of available subscribers for reproducing, for example, the audio data in a non-compressed form reduces the costs of the local network with its various data sources and data sinks. One or both types of decompressed data, that is audio and also video data, can be conducted through the optical data line to the appropriate subscribers for reproducing these data. The efficiency of data transmission is noticeably improved compared to the transmission of the pure decompressed data.

In one embodiment, the jointly transmitted audio and video data are first separated from one another in a first data sink by a separation stage. The separated data are then individually decoded in separate bit stream decoders, and are conducted, as decompressed audio data and compressed video data to the appropriate output units for reproduction. The compressed audio

data and/or the compressed video data of the optical data line are here conducted to the local network and, through this, to an appropriate subscriber, which acts as a centralized data sink for these particular compressed data types. This data sink contains the bit stream decoder for decoding the received, compressed data. The bit stream decoder is centralized at the reproduction site, which reduces the number of bit stream decoders for the audio data and video data for the entire local network. This structure of the inventive local network with transmission of the compressed audio data and transmission of the compressed video data optimally utilizes the maximum transmission capacity of the ring network.

The local network includes a control unit, which is preferably situated in a data sink, and controls the transmission of the data, whether these be compressed audio data, compressed video data, decompressed audio data and/or decompressed video data. These data are transmitted via the optical data line of the local network to the appropriate other subscribers so that they can be reproduced there. This control unit assures that, at each moment, the appropriate transmission capacity for the transmission of data through the optical data line will be available. This control unit assures the allocation of the required data channels in the local network.

The data connection between the data sources and the data sinks can be controlled by control data transmitted through the data line. This assures a reliable buildup of the data connections, the assignment of the data sinks to the data sources, control of reproduction in the data sinks, and control of data decoding. In particular, it has proven beneficial to switch the bit stream decoder between several modes of decoding function by the transmitted control data. In this way, a single bit stream decoder, which especially is situated in the data stream before the separation stage, can read several compressed data formats and can correctly decompress them in accordance with the selected decoding function. It has proven beneficial to have a decoder for the

video data compression formats, which typically comprise for example the MPEG-1 format, the MPEG-2 format, and the JPEG format, as well as for the audio data compression formats, mainly the AC-3, the MPEG-1, and the MPEG-2. This capability of switching the bit stream decoder between the individual decoding formats, can further reduce the number of required bit stream decoders and thus reduce the costs of the local network.

These and other objects, features and advantages of the present invention will become more apparent in light of the following detailed description of preferred embodiments thereof, as illustrated in the accompanying drawings.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 is a functional block diagram illustration of a multimedia local network having a centralized bit stream decoder; and

FIG. 2 is a functional block diagram illustration of an alternative embodiment multimedia local network.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 is a functional block diagram illustration of a multimedia local network 100. The network includes a plurality of subscribers 2, 3, 4, 5, which are connected in a ring through an optical data line 1. Each of the subscribers 2, 3, 4, 5 has two connections to the optical data line 1, one to an incoming optical data line 1, and one to an outgoing optical data line 1. Audio data, video data, and also control data are exchanged among the individual subscribers through the optical data line 1.

The subscribers 2 is configured as a data source for compressed audio and video data. For

example, the subscriber 2 may include a DVD player, which provides compressed audio and video data, and outputs the compressed audio and video data jointly, to its outgoing data line 1. The jointly transmitted compressed audio and video data are conducted via the optical data line 1 to the data sink 5. The data sink 5 includes a bit stream decoder 6, which decodes and decompresses the audio and video data, and provides decompressed audio data and video data provided to a separation stage 7. The separation stage 7 separates the jointly decoded audio and video data according to their type, and outputs these to the optical data line 1 for forwarding to the other data sinks 3, 4.

The data sink 5 also includes a control unit 8 that controls transmission of the mutually separated, decompressed data types to the other data sinks 3, 4. The control unit 8 assures the allocation of the mutually separated, decompressed data types to the individual data channels in the single optical data line 1.

The separately transmitted, decompressed audio data and video data are conducted to the data sink 4, which has a display screen 9. The decompressed input video data are processed in the data sink 4 into for example an electrical FBAS signal, which is used to drive the display 9, so the video signals can be reproduced visually.

The decompressed audio data are conducted, via the data sink 4 and the data source 2, to the data sink 3, where the decompressed audio data are processed, amplified, and are acoustically reproduced by the connected output units, for example, loudspeakers 11. The audio signals conducted through the data line 1 may also be processed digitally, especially by equalizing, fading, delay lines, and the like.

Notably, the local network of FIG. 1 has an economical data source 2, which does not require a bit stream decoder, and which outputs the generated audio and video data in compressed

form to the data line 1. This loading of the network with compressed data by the data source 2 results in efficient utilization of the transmission capacity of the network. Furthermore, the local network preferably has a single bit stream decoder 6 in a central data sink 5. The single bit stream decoder 6 decodes the compressed audio and video data which are jointly conducted to it from the data source 2, and conducts the decompressed data via the optical data line 1 to the appropriate output units 9, 11, where they are reproduced. The use of a single bit stream decoder 6 results in a very economical design for the local network.

The bit stream decoder 6 decodes the compressed audio data and decompressed video data jointly and simultaneously in accordance with the particular compression format, and conducts these decoded, decompressed audio and video data to the separation stage 7.

Despite the increased power required for the bit stream decoder 6, this centralization makes the local network more economical than systems that include distributed decoding/decompression. This is true all the more so if several data sources and/or data sinks are present in addition to the single data source 2 and the single data sink 3 for audio data and the single data sink 4 for video data.

A ring topology and with a single optical data line 1, prevents undesirable interference from entering the data line. This is particularly desirable for applications in automobiles. The ring topology makes it possible to do without network nodes, and as a result utilizes the maximum transmission capacity of the optical data line and respectively of the ring network. This achieves a local network which is not only economical but which efficiently utilizes its maximum transmission capacity.

FIG. 2 is a functional block diagram illustration of an alternative embodiment multimedia local network. In this embodiment of the local network, the subscribers 2, 3, 5 are connected

through the optical ring data line 1. The data source 2 corresponds to data source 2, as this is shown in FIG. 1. It generates compressed audio and video data and outputs these to the optical data line 1. These data then pass through the data sink 3 to the data sink 5, which, by means of the separation stage 7, divides these compressed audio and video data into compressed audio data and compressed video data. The control unit 8 allocates the data channels in the optical data line 1 of the local network, for transmission of the compressed audio data to the data sink 3, 10, and for transmission of the compressed video data to the output unit 9 for video data.

This output unit 9 has a bit stream decoder 6, which converts the compressed video data into a decompressed video signal, here an electrical RGB signal, which is reproduced on the display of the output unit 9.

The data sink 3, 10 for the compressed audio data also has a bit stream decoder 6, which here is designed as an AC-3 decoder. The AC-3 decoder decodes the compressed audio data, and provides decompressed audio data to a processing and amplification stage 12, which again conducts the processed and amplified audio signals to the loudspeakers 11.

This inventive structure of the local network, with a separation stage 7 in the compressed data stream, situated before the respective bit stream decoder 6 assigned to it, optimally utilizes the maximum transmission capacity of the local network. Exclusively compressed audio and video data are transmitted on the optical data lines 1 between the individual subscribers 2, 3, 5. Although this structure has a plurality of bit stream decoders 6, these are designed very specifically only as audio bit stream decoders 6 for decoding compressed audio data or only as video bit steam decoders for decoding compressed video data. Through this specific requirement, it is possible, despite the greater number of bit stream decoders 6, to keep the costs of the local network low, taking into account the optimized efficiency in utilizing the maximum transmission

capacity of the network.

Although the present invention has been shown and described with respect to several preferred embodiments thereof, various changes, omissions and additions to the form and detail thereof, may be made therein, without departing from the spirit and scope of the invention.

What is claimed is: